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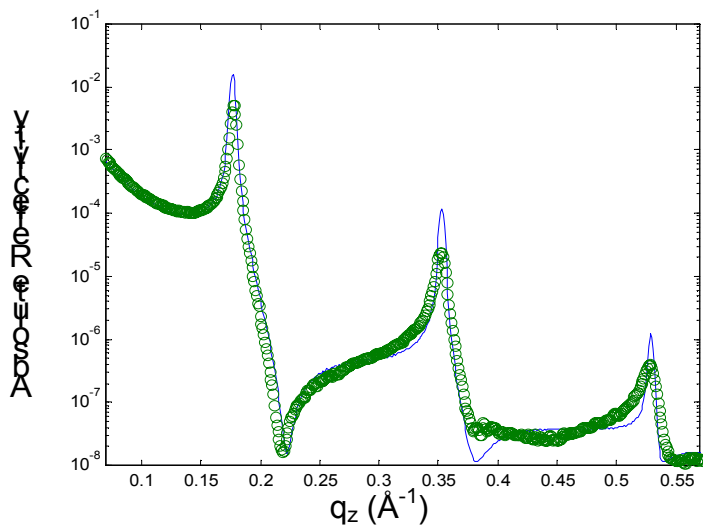
X-ray Reflectivity in Silica Templated Mesoporous Systems

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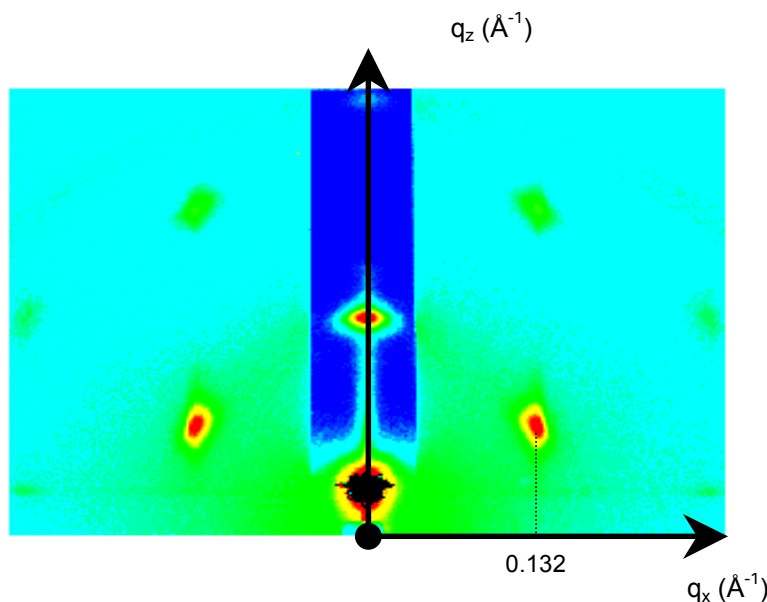
Beamline(s): X22A

We have performed x-ray reflectivity measurements of mesoporous thin films of silica templated by CTAB and Brij56 surfactants. The thin films were deposited on silicon wafer by spin and dip coating. The aim of this experiment was to obtain structural informations about the size of the mesopores together with their arrangement in the direction normal to the surface of the films. It is indeed quite amazing to see that despite the fact that the MCM41 family has been extensively studied for the past ten years no attempt

was made to use reflectivity measurements to bring out such structural information. The experiment was carried out on the X22A beam line of the NSLS. We can observe in the reflectivity curve a series of Bragg reflections, which are consistent with a periodic arrangement of the mesophase in the direction normal to the substrate.



In addition next to the Bragg peaks, one can clearly observe pronounced dips in the reflectivity curve that are very likely the signature of the shape of the cylindrical pores. A model based on cylindrical micelles organized on a hexagonal lattice has been developed to explain within the Born approximation the profile of the reflectivity curve (solid line in the figure). GISAXS (grazing incidence small angle x-ray scattering) measurements were also performed on the X21 beam line on the same samples to probe the off-specular reciprocal space. The 2D diffraction pattern was collected at grazing incidence on a MAR CCD detector. One can clearly observe on the GISAXS image the presence of Bragg reflections both in the specular and off-specular directions. The position of the Bragg peaks is consistent with a disorted hexagonal lattice that we describe as rectangular face centered lattice with lattice parameters $a=4.8\text{nm}$ and $c=7.1\text{nm}$.



The analysis of the results is presently in progress and we believe that we can extract from such measurements the pore diameter, the distance between two pores and the silica wall thickness.